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| 10/716,265 | 11/17/2003 | Thomas Pun | APLE.P0037 | 6487 |

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| EXAMINER | |
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| WERNER, DAVID N | |
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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

| *Office Action Summary* | **Application No.** 10/716,265 | **Applicant(s)** PUN ET AL. | |
|---|---|---|---|
| | **Examiner** David N. Werner | **Art Unit** 2621 | |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on 29 December 2008.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) 1,3-5,7-14,16,18-20,22-29,31,32,34,35 and 37-42 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1,3-5,7-14,16,18-20,22-29,31,32,34,35 and 37-42 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on 02 August 2007 is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☐ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date 20081111,20090221.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

## DETAILED ACTION

1. This Office action for U.S. Patent Application 10/716,265 is responsive to communications filed 29 December 2008 in reply to the telephonic interview of 03 December 2008. Currently, claims 1, 3–5, 7–14, 16, 18–20, 22–29, 31, 32, 34, 35, and 37–42 are pending.

2. In the Final Rejection of 12 October 2007, claims 1–4, 14–19, 29–32, 34, and 35 were rejected under 35 U.S.C. 102(b) as anticipated by U.S. Patent 6,160,846 A (Chiang et al.). Claims 5–10, 12, 13, 20–25, 27, 28, 33, and 36 were rejected under 35 U.S.C. 103(a) as obvious over Chiang et al. in view of U.S. Patent 6,167,085 A (Saunders et al.). Claims 11 and 26 were rejected under 35 U.S.C. 103(a) as obvious over Chiang et al. in view of Saunders et al. and in view of U.S. Patent 7,079,581 B2 (Noh et al.).

### *Continued Examination Under 37 CFR 1.114*

3. A request for continued examination under 37 CFR 1.114 was filed in this application after appeal to the Board of Patent Appeals and Interferences, but prior to a decision on the appeal. Since this application is eligible for continued examination under 37 CFR 1.114 and the fee set forth in 37 CFR 1.17(e) has been timely paid, the appeal has been withdrawn pursuant to 37 CFR 1.114 and prosecution in this application has been reopened pursuant to 37 CFR 1.114. Applicant's submission filed on 27 October 2008 has been entered.

### ***Response to Arguments***

4. Applicant's arguments with respect to claim 1 have been considered but are moot in view of the new ground(s) of rejection. As discussed in the 03 December 2008 interview, in the present invention, determining buffer occupancy accumulation is performed at the frame level, not the macroblock level, as in Chiang et al. However, "Scalable Rate Control for MPEG-4 Video" (Lee et al.) teaches that it was known to perform the same type of rate control at different levels in a video coder, such as frame level, macroblock level, and object level. As will be shown below, by scaling the macroblock-level rate-control system of Chiang et al. to the frame level, as in Lee et al., all limitations of claim 1 are disclosed.

5. Applicant's arguments with respect to claims 5 and 14 have been considered but are moot in view of the new ground(s) of rejection. Although in Saunders et al., quantization adjustment is based on local image complexity properties and not a scaling function or delta value as in the present invention, U.S. Patent 5,847,766 A (Peak) discloses this limitation.

### ***Specification***

6. The specification is objected to as failing to provide proper antecedent basis for the claimed subject matter. See 37 CFR 1.75(d)(1) and MPEP § 608.01(o). Correction of the following is required: the specification provides no support for the claimed "computer-readable medium" or "processor" in claims 16, 18–20, 22–29, 31, and 35.

## *Claim Rejections - 35 USC § 101*

7. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

Claims 16, 18–20, 22–29, 31, and 35 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter. As discussed in the 03 December 2008 Interview, the description of the program as executable "by at least one processor" incorporates an embodiment in which the program is executed across different processors in a network, and so the claimed "computer-readable medium" is considered to encompass a non-statutory communication signal across the network.

## *Claim Rejections - 35 USC § 103*

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

9. Claims 1, 3, 4, 16, 18, 19, 32, 35, and 37 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 6,160,846 A (Chiang et al.) in view of "Scalable Rate Control for MPEG-4 Video" (Lee et al.). Chiang et al .teaches a system for encoding a video that selects a quantizing scale to maintain video quality. Regarding

claim 1, figure 1 of Chiang et al. shows encoder 100 with rate control module 130 that monitors and adjusts the bit rate of the data stream entering buffer 190 to prevent buffer overflow and underflow (column 8: lines 48–55). Rate control module 130 adjusts the quantizer scale based on the complexity of a frame (column 8: line 64–column 9: line 21), and attempts to maintain an optimal bit rate that preserves image quality (column 8: lines 56–63). In one embodiment of Chiang et al., illustrated in figure 4, the data resulting from an encoding process is used to compute the quantizer scale for the next macroblock. In step 415, a buffer fullness measure Ri is calculated as $R_i = R_0 + B_{i-1} - \frac{T*(i-1)}{N_{MB}}$, in which the first term is the initial buffer fullness measure, the second term is the number of bits encoded in the previous macroblocks in the present frame, and the third term is the budgeted number of bits per macroblock in the present frame (column 13: lines 42–57). Then, this calculation incorporates a "buffer occupancy accumulator" as a difference between an actual amount of bits used to encode a previous macroblock and a requested amount of bits. Since this buffer fullness measure Ri is designed to ensure prevention of buffer overflow if over the buffer size or underflow when the buffer is empty (column 13: lines 60–65) and is dependent, in part, on T, the target bit budget for a previous frame having the same type as the current frame (column 13: lines 37–41, 45, 55–56), change in Ri is limited "based upon the frame type". Chiang et al. then calculates a quantizer value for the current macroblock based on Ri (column 13: line 67–column 14: line 6), and encodes the macroblock with this quantizer (column 14: lines 8–11).

The present invention differs from Chiang et al. in that in the present invention, the buffer occupancy is determined from a discrepancy in bit count at the frame level and in Chiang et al. the buffer occupancy is determined from a discrepancy in bit count at the macroblock level.

Lee et al. describes a rate control system for the MPEG-4 codec. Regarding claim 1, in Lee et al., the rate control is based on a rate and distortion at a scalable level, operating in similar or identical fashions on the frame level, object level, and macroblock level, as shown in figure 2 (§ II). At a pre-encoding stage, a target bit count for a current P frame is based on the number of bits used to encode the previous P frame, and further adjusted according to buffer fullness, which is adjusted to stay about half capacity (§ II.C). At the encoding stage, an actual bit rate for a current frame or object is recorded, and the macroblock-layer rate control, as in Chiang et al., is also performed.

Chiang et al. discloses the present invention except for frame-level buffer fullness control. Lee et al. teaches that it was known to adjust encoding on a difference between actual bit count and target bit count at the frame level. Therefore, it would have been obvious to one having ordinary skill in the art at the time of the present invention to scale the macroblock-level buffer fullness and rate control system of Chiang et al. to the frame level, as taught by Lee et al., since Lee et al. states in Section IV.A that such a modification would reduce variation from target bit rate.

Regarding claim 3, in an emergency situation, to prevent immanent buffer overflow, Chiang et al. discards high-frequency DCT coefficients of a block and only transmits low-frequency coefficients (column 2: lines 9–15).

Regarding claim 4, in Chiang et al., buffer fullness measure Ri is used to establish a quantizer scale value that varies depending on buffer fullness (column 13: lines 60–65).

Regarding claims 16, 18, and 19, Chiang et al. discloses a software embodiment of the encoder (claims 18–23).

Regarding claims 32 and 35, an MPEG-encoded video as in Chiang et al. is comprised of I-frames, which are intra-frame encoded, and B and P frames, which are inter-frame encoded (column 4: line 44; column 6: lines 25–31).

Regarding claim 37, in Lee et al., buffer size is limited to a small variation from half capacity at the frame rate (§ IV.A).

10. Claims 5, 7–10, 12-14, 20, 22–25, 27–29, 31, 34, 38, 39, and 42 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chiang et al. in view of U.S. Patent 5,847,766 A (Peak), cited in the Information Disclosure Statement of 21 February 2009. Claims 5 and 20 are directed to encoding digital video using a quantizer value calculated as the sum of a base quantizer value and a quantizer adjustment. Chiang et al. does not teach this feature, instead determining a quantizer value as the product of a base quantizer value and an adjustment.

Peak is directed to a video encoder. Regarding claim 5, in Peak, a macroblock is given a "Reference quantization step size" R(Q) based on human sensitivity to color detail in the block according to a classification (column 4: lines 19–43), producing a first estimate of quantization. This is the claimed step of determining a base quantizer value. Next, in adjustment unit 24, RQ is adjusted according to an error between a target bit count TB and an estimated accumulated bit count EB (column 6: lines 40–52). This adjustment is the claimed "quantizer adjustment". This adjustment is given a weight W(MC) based on macroblock classification, which in turn is dependent on frame type (Table 2). Then, the quantizer adjustment is based on a scaling function. As shown in equation 6, the adjustment is performed by subtracting the weighted difference, which is mathematically equivalent to the claimed summing operation.

Chiang et al. discloses the claimed invention except for determining a quantization level for a block as a sum of a base quantization level and an adjustment. Peak teaches that it was known to determine a final quantization level for a block based on adding an adjustment term to an initial quantization step. Therefore, it would have been obvious to one having ordinary skill in the art at the time of the present invention to modify the encoder of Chiang et al. to incorporate the quantization adjustment system of Peak, since Peak states in column 7: lines 20–24 that such a modification would increase the compression ratio and improve quality of the decoded image.

Regarding claims 7 and 8, in Peak, macroblock classification MC is determined in part in edge data in a macroblock and complexity of macroblock data (Table 1).

Regarding claim 9, error B(ERROR) between target bit value TB and estimated bit count EB (column 6: line 44) is the claimed difference.

Regarding claim 10, again, as shown in Table 2 of Peak, macroblock classification is different for I frame, P frame, and B frame macroblocks.

Regarding claim 12, macroblock complexity in the classification system of Peak is the claimed macroblock activity measure normalization.

Regarding claim 13, as shown in Table 2 of Peak, for I frames, RQ is in a finite range of 4 to 24; for P frames, 4 to 20; and for B frames, 5 to 24.

Regarding claim 38, in Chiang et al., "macroblock coding modes...are grouped into two broad classifications, inter mode coding and intra mode coding" (column 6: lines 55–57).

Regarding claim 39, as shown in equation 6 of Peak, two of the factors of the adjustment level are the error value B(ERROR), which is the claimed difference, and weight W[MC], which is dependent on classification, and so is the claimed normalized activity level.

Regarding claims 20, 22–25, 27, and 28, Chiang et al. discloses a software embodiment of the invention (claims 18–23).

Regarding independent claim 14, in Chiang et al., in equation 15, the T term is the claimed "number of bits that should have been used to encode all previously encoded macroblocks of the particular frame". Since T is different for an I frame, P frame, or B frame (column 13: lines 35–41, 56, 57), the formula for the term in equation

15 varies according to frame type. The difference between the B term and the T term (column 13: lines 54–59) is the claimed "delta value". Then, using this as B(ERROR) in Peak and performing the quantization adjustment described therein, this is the claimed step of quantizing the macroblock as the sum of the base and adjustment based on the delta value.

Regarding claim 34, an MPEG-encoded video as in Chiang et al. is comprised of I-frames, which are intra-frame encoded, and B and P frames, which are inter-frame encoded (column 4: line 44; column 6: lines 25–31).

Regarding claim 42, as shown in equation 6 of Peak, two of the factors of the adjustment level are the error value B(ERROR), which is the claimed difference, and weight W[MC], which is dependent on classification, and so is the claimed normalized activity level.

Regarding claims 29 and 31, Chiang et al. discloses a software embodiment of the invention (claims 18–23).

11. Claims 11, 26, 40, and 41 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chiang et al. in view of Peak as applied to claims 5, 14, and 20 above, and further in view of U.S. Patent 7,079,581 B2 (Noh et al.). Claims 11, 26, 40, 41 teach adjusting a quantizer value in a video encoder based on the normalized sum of absolute differences. Although Chiang et al. teaches motion compensation, this is not necessarily factored into calculating a quantization scale. Additionally, in Peak, the error value itself is not normalized. Noh et al. teaches an apparatus and method for

controlling a variable bit rate for a video encoder in real time. Regarding claims 11 and 26, Noh et al. discloses a variable bit rate (VBR) controller that determines a quantization factor for a video encoder based on frame complexity (column 1, lines 45-56). Figure 1 of Noh et al. shows encoder 100 with VBR controller 50, which contains Mean Absolute Difference (MAD) calculator 51. The MAD value for a frame is directly used to model complexity of the frame (column 3, lines 48-49). This result is used as an input for target bit rate decision unit 52 and quantization factor decision unit 54 (column 3, lines 61-64).

Chiang et al., in combination with Peak, discloses the claimed invention except for determining a quantizer scale based on a sum of absolute differences. Noh et al. teaches that it was known to determine a quantization factor based on mean absolute difference. Therefore, it would have been obvious for one having ordinary skill at the time the invention was made to set a quantizer according to an absolute difference calculation as taught by Noh et al., since Noh et al. states in column 3, lines 31-34 that such a modification would "[minimize] deterioration of the quality of an image while increasing the encoding efficiency" (column 3, lines 31-34).

## ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to David N. Werner whose telephone number is (571)272-9662. The examiner can normally be reached on Monday-Friday from 10:00-6:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mehrdad Dastouri can be reached on (571) 272-7418. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/D. N. W./
Examiner, Art Unit 2621

/Mehrdad Dastouri/
Supervisory Patent Examiner, Art Unit 2621